IN THE CLAIMS

65. (Original) A method for applying digital watermarking image data or digital watermarking audio data to an unlabeled digital image, audio, or video data sample, said method including the steps of:

a) inputting a set of unlabeled digital data and a set of digital watermark data;

b) formatting the unlabeled digital data into a format suitable for orthogonal transformation;

c) performing an orthogonal transformation on the formatted unlabeled data to produce a set of unlabeled data transform coefficients;

d) formatting the digital watermark data into a format suitable for orthogonal transformation;

e) performing an orthogonal transformation on the formatted watermark data to produce a set of watermark data transform coefficients;

f) for each watermark data transform coefficient, allocating an unlabeled data transform coefficient to be replaced and replacing the respective unlabeled data transform coefficients to produce a labeled set of data transform coefficients;

g) storing the locations into which watermark data transform coefficients were encoded in the set of labeled data transform coefficients to generate a unique key for future decoding of the watermark data;

h) performing an inverse orthogonal transformation on the labeled data transform coefficients to convert them into a set of labeled digital data having a form resembling the original unlabeled digital data.

66. (Original) The method of claim 65 wherein the step of formatting the watermark data includes the step of mapping the set of watermark data into a two-dimensional matrix.

67. (Original) The method of claim 66 wherein the step of formatting the watermark data includes the step of dividing the two-dimensional matrix of watermark data into smaller sub-blocks and the step of performing the orthogonal transformation on the watermark data

involves performing the orthogonal transform on each sub-block of the watermark data, such that the watermark data transform coefficients are organized in sub-blocks.

68. (Original) The method as claimed in claim 67, including an ordering step in which each sub-block of the watermark data transform coefficients are reordered into a one--dimensional array in approximately increasing frequency order, as hereinbefore defined, prior to replacement of the allotted unlabeled data transform coefficients with the watermark data transform coefficients.

69. (Original) The method of claim 68, in which the step of reordering the watermark data transform coefficients of each sub-block is achieved by performing a zig-zag scan of the watermark data transform coefficients in the respective sub-block.

70. (Original) The method of claim 68, in which the step of reordering the watermark data transform coefficients of each sub-block is achieved by performing a radial scan of the watermark data transform coefficients in the respective sub-block .

71. (Original) The method as claimed in claim 69, wherein after the watermark data transform coefficients of each sub-block are reordered into a one-dimensional array and before the replacement of unlabeled data transform coefficients with the watermark data the watermark data transform coefficients of each one-dimensional array are rescaled.

72. (Original) The method as claimed in claim 71, wherein the rescaling is performed using a scaling function that reduces the magnitude of lower frequency coefficients of the one-dimensional array by a greater amount than higher frequency coefficients of the respective array.

73. (Original) The method of claim 72, wherein the scaling function has an exponential characteristic.

74. (Original) The method of claim 68 including the step of dividing the reordered watermark data transform coefficients of each sub-block into segments for subsequent replacement into the set of transformation coefficients of the unlabeled data.

75. (Original) The method as claimed in claim 65, wherein the step of formatting the unlabeled data includes the step of mapping the set of unlabeled data into a two- dimensional matrix.

76. (Original) The method of claim 75 wherein the step of formatting the unlabeled data includes the step of dividing the two-dimensional matrix of unlabeled data into smaller sub-blocks and the step of performing the orthogonal transformation on the unlabeled data involves performing the orthogonal transform on each sub-block of the unlabeled data, such that the unlabeled data transform coefficients are organized in sub-blocks.

77. (Original) The method of claim 76, including a first ordering step in which each sub-block of the unlabeled data transform coefficients are reordered into a one- dimensional array in approximately increasing frequency order, as hereinbefore defined, prior to replacement of allocated unlabeled data transform coefficients with watermark data transform coefficients, and a second ordering step in which each of the one-dimensional arrays of the labeled data transform coefficients are reordered into sub-blocks using an inverse reordering to that of the first ordering step.

78. (Original) The method of claim 77, wherein the first ordering step is achieved by performing a zig-zag scan of each sub-block of the unlabeled data transform coefficients and the second ordering step is achieved by performing an inverse zig-zag scan of each one-dimensional array of the labeled data transform coefficients.

79. (Original) The method of claim 77, wherein first ordering step is achieved by performing a radial scan of each sub-block of the unlabeled data transform coefficients and the second ordering step is achieved by performing an inverse radial scan of each one-dimensional array of the labeled data transform coefficients.

80. (Original) The method of claim 78, including the step of, for each one-dimensional array of unlabeled data, determining a location beyond which the ac energies will fall below a certain threshold value and selecting transform coefficients beyond that location for replacement by transform coefficients of the watermark data.

81. (Original) The method of claim 80, including the step of calculating the mean and variance values of the ac energies from the orthogonal transformation coefficients for each one-dimensional array of unlabeled data and calculating the threshold value as a function of the mean and variance values.

82. (Original) The method as claimed in claim 76, including the step of, for each one-dimensional array of the unlabeled data, allocating a segment of the orthogonally- transformed watermark data that will be encoded in that sub-block, if any.

83. (Original) The method as claimed in claim 65, wherein the orthogonal transform performed on the unlabeled data is selected from the group consisting of a Discrete Cosine Transform (DCT); a Fourier transform; a Walsh-Hadamard transform; a Haar transform; a sine transform; and a Wavelet transform, and the inverse transform is respectively; an inverse DCT; an inverse Fourier transform; an inverse Walsh-Hadamard transform; an inverse Haar transform; an inverse sine transform; and an inverse Wavelet transform.

84. (Original) The method as claimed in claim 83, wherein the orthogonal transform performed on the unlabeled data is a Discrete Cosine Transform (DCT) and the inverse transform is an inverse DCT.

85. (Currently Amended) The method as claimed in claim 65, wherein the orthogonal transform performed on the watermark data is selected from the group consisting of a Discrete Cosine Transform (DCT); a Fourier ~~transfonn~~ transform; a Walsh-Hadamard transform; a Haar transform; a sine transform; and a Wavelet transform.

86. (Original) The method as claimed in claim 85, wherein the orthogonal transform performed on the watermark data is a Discrete Cosine Transform (DCT).

87. (Original) The method as claimed in claim 65, including the further step of allocating in a structured manner a segment of the orthogonally-transformed unlabeled data that will be replaced by each segment of orthogonally transformed watermark data.

88. (Original) The method as claimed in claim 65, including the further step of allocating in a random manner a segment of the orthogonally-transformed unlabeled data that will be replaced by each segment of orthogonally transformed watermark data.

89. (Original) The method as claimed in claim 65, wherein the set of unlabeled digital data is obtained from a sample stream representing a digitized grayscale or color image.

90. (Original) The method as claimed in claim 89, wherein the digitized grayscale or color image is obtained from a digital still camera or a digital image scanner.

91. (Original) The method as claimed in claim 65, wherein the set of unlabeled digital data is obtained from a sample stream representing digitized video.

92. (Original) The method of claim 91, wherein the unlabeled digitized video is obtained from a Data Storage Medium (DSM), or a real time digital data source.

93. (Original) The method as claimed in claim 65, wherein the labeled digitized video is subsequently transmitted over a digital communications channel.

94. (Original) The method as claimed in claim 65, wherein the labeled digitized video is subsequently recorded on a digital recording medium.

95. (Original) The method as claimed in claim 94, wherein the digital recording medium is selected from the group consisting of a Video Compact Disc (VCD); a Laser Disc (LD); a

Digital Versatile Disc (DVD); a digitized movie and a still image contained within a video game, video-on-demand or other software.

96. (Original) The method as claimed in claim 65, wherein the unlabeled digital data is obtained from a sample stream representing one or more channels of digitized sound or music.

97. (Original) The method of claim 96, wherein the unlabeled digitized sound or music is obtained from either a master recording on digital audio tape played on a digital tape recorder or a master recording on an analog audio tape played on an analog tape recorder and digitized via a digitizing interface.

98. (Original) The method as claimed in claim 96, wherein the labeled digitized sound or music is subsequently recorded on a digital recording medium.

99. (Original) The method as claimed in claim 98, wherein the digital recording medium is selected from the group consisting of a compact Disc (CD); a Digital Audio Tape (DAT); a Laser Disc (LD); a Video Compact Disc (VCD).

100. (Original) The method as claimed in claim 65, wherein the watermark digital data includes one or more of the following data items: an owner's logo; an owner's trademark; a personal identification; an artist's recorded voice; or general terms for publisher distribution.

101. (Original) A method for extracting digital watermarking image data or digital watermarking audio data from a digital image, audio, or video data sample, said method including the steps of:

a) inputting a set of labeled digital data and unique key data containing information of locations of watermark data imposed as a label on the labeled digital data;

b) mapping the set of labeled digital data into a format suitable for orthogonal transformation;

c) performing an orthogonal transformation on the formatted labeled data to produce a set of labeled data transform coefficients;

d) using the unique key to extract transform coefficients of orthogonally transformed watermark data from the locations in the set of labeled data transform coefficients specified in the key;

e) using an inverse orthogonal transformation on the transformed watermark data to retrieve the embedded watermark data.

102. (Original) The method of claim 101 wherein the step of formatting the labeled data includes the step of mapping the set of labeled data into a two-dimensional matrix.

103. (Original) The method of claim 102 wherein the step of formatting the labeled data includes the step of dividing the two-dimensional matrix of labeled data into smaller sub-blocks and the step of performing the orthogonal transformation on the labeled data involves performing the orthogonal transform on each sub-block of the labeled data, such that the labeled data transform coefficients are organized in sub-blocks.

104. (Original) The method as claimed in claim 103, including the step of ordering the orthogonal transformation coefficients of the labeled data in each sub-block into a one-dimensional array in approximately increasing frequency order, as hereinbefore defined, prior to extraction of the watermark data coefficients.

105. (Original) The method as claimed in claim 104, wherein the ordering step is achieved by performing a zig-zag scan of each sub-block of orthogonally transformed labeled data.

106. (Original) The method as claimed in claim 104, wherein the ordering step is achieved by performing a radial scan of each sub-block of orthogonally transformed labeled data.

107. (Original) The method of claim 101, wherein after extraction of the watermark transform coefficients from the orthogonally transformed labeled data, the extracted watermark data transform coefficients are arranged into a number of one-dimensional arrays corresponding to the number of sub-blocks used in the process of encoding the watermark data into the labeled

data and each one-dimensional array is then reordered into a two-dimensional sub-block prior to performing the inverse orthogonal transform on the watermark data transform coefficients in each sub-block.

108. (Original) The method of claim 107, wherein the reordering of each one-dimensional array of watermark data transform coefficients into a respective sub-block is achieved by performing an inverse zig-zag scan.

109. (Original) The method of claim 107, wherein the reordering of each one-dimensional array of watermark data transform coefficients into a respective sub-block is achieved by performing an inverse radial scan.

110. (Original) The method as claimed in claim 101, wherein the transform coefficients of the watermark data embedded in the labeled digital data are compressed using a first scaling function and the method includes the step of expanding the compressed watermark data prior to the inverse orthogonal transformation using a second scaling function which is an inverse of the first scaling function.

111. (Original) The method of claim 110, wherein the inverse scaling function increases the magnitude of lower frequency coefficients of each one-dimensional array of watermark data to a greater extent than it increases the magnitude of the higher frequency coefficients of the respective one dimensional array.

112. (Original) The method of claim 110, wherein the first scaling function has an exponential characteristic and the second scaling function has an inverse exponential characteristic.

113. (Original) The method as claimed in claim 101, wherein the orthogonal transform performed on the labeled data is selected from the group consisting of a Discrete Cosine Transform (DCT); a Fourier transform; a Walsh- Hadamard transform; a Haar transform; a sine transform; and a Wavelet transform.

114. (Original) The method as claimed in claim 113, wherein the orthogonal transform performed on the labeled data is a DCT.

115. (Original) The method as claimed in claim 101, wherein the inverse orthogonal transform performed on the watermark data is selected from the group consisting of an inverse Discrete Cosine Transform (DCT); an inverse Fourier transform; an inverse Walsh-Hadamard transform; an inverse Haar transform; an inverse sine transform; and an inverse Wavelet transform.

116. (Original) The method as claimed in claim 115, wherein the inverse orthogonal transform performed on the watermark data is an inverse DCT.

117. (Original) The method as claimed in claim 101, including the further step of displaying the watermark data samples for immediate examination or authentication.

118. (Original) The method as claimed in claim 101, including the further step of storing the watermark data samples for future examination or authentication.

119. (Original) The method as claimed in claim 101, wherein the labeled digital data is obtained from a sample stream representing a digitized grayscale or color image.

120. (Original) The method as claimed in claim 119, wherein the labeled digitized grayscale or color image is obtained from a digital still camera or a digital image scanner.

121. (Original) The method as claimed in claim 101, wherein the labeled digital data is obtained from a sample stream representing digitized video.

122. (Original) The method of claim 121, wherein the labeled digitized video is obtained from selected from the group consisting of a Video Compact Disc (VCD) played on a VCD player; a Laser Disc (LD) played on a LD player; a Digital Versatile Disc (DVD) played on a

DVD player; a digitized movie or still image contained within a video game or other software or a digital signal transmitted over a communications channel.

123. (Original) The method as claimed in claim 101, wherein the labeled digital data is obtained from a sample stream representing one or more channels of digitized sound or music.

124. (Original) The method of claim 123, wherein the labeled digitized sound or music is obtained from the group consisting of a Compact Disc (CD) played on a CD player; a Digital Audio Tape (DAT) played on a DAT player; a Laser Disc (LD) played on a LD player; from a Video Compact Disc (VCD) played on a VCD player.

125. (Original) The method as claimed in claim 101, wherein the watermark digital data includes one or more data items selected from the group consisting of an owner's logo; an owner's trademark; a personal identification; an artist's recorded voice; and general terms for publisher distribution.

126. (Currently Amended) An apparatus for applying digital watermarking image data or digital watermarking audio data to an unlabeled digital image, audio, or video data sample, said apparatus including:

a) input means arranged to input a set of unlabeled digital data;

b) processing means arranged to process the unlabeled digital data to encode watermark data into the unlabeled data to form a set of labeled digital data; and

c) output means arranged to output the labeled digital data to a communication or storage medium~~, wherein the processing means is arranged to perform the method as claimed in claim 65~~.

127.(Currently Amended) An apparatus for extracting digital watermarking image data or digital watermarking audio data from a labeled digital image, audio, or video data sample said

apparatus including:

a) input means arranged to input a set of labeled digital data;

b) processing means arranged to process the labeled digital data to extract watermark data encoded into the labeled digital data; and

c) output means arranged to output the extracted watermark digital data to a display or storage means~~, wherein the processing means is arranged to perform the method as claimed in claim 101~~.

128. (Original) A digital recording stored on any digital recording medium, the recording comprising a set of digital image, audio, or video data labeled with a watermark comprising a set of digital watermark image data or a set of digital watermark audio data, the set of labeled digital data being created by encoding a set of unlabeled digital data with the set of digital watermark data using the method as claimed in claim 65.